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Description: It concerns heating elements for a filter press the instant invention heating elements for a filter press which several alternate membrane filter elements and heating elements in line clampable into a press framework enclosure, whereby the filter press is feedable chargenweise sludge flowable which can be dried with one in the initial state, that first by mechanical press pressure, then by a subjecting of fluid pressure medium and final by thermal drying process, to that, the membrane filter elements, the heating elements with fluids, D. h. liquid or gaseous heating medium are feedable, is drainable.

From the EP 0.759,318 aluminium a method and an apparatus are known for dehumidifying and drying Solid Flüs sigkeits mixtures, in particular of solid Suspensionen and sludge, whereby the slurry in a filter press, which can be treated, is dehumidified and subjected the formed filter cakes a subsequent drying process. The slurry will over the Zulaufleitung of a number from next to each other, which can be treated, and parallel to each other disposed filter elements supplied, which are with filter medium covered and over a drainage connected to a collecting pipe, over which the filtrate derived becomes, while the solid contents become retained as filter cakes before the filter medium and whereby the dehumidified good becomes by heat input dried. This

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Drying process made thereby in several steps: with the dewatering formed filter cakes becomes reciprocally approximately in each case between two filter elements and parallel this disposed heating elements pressed, which become heated on a constant drying temperature; pressing the filter cake in slightly to the surfaces of the heating elements made by means of bottom pressure a standing gas, which becomes supplied over the collecting pipe and the drainage; after the heating of the filter cake on a predetermined temperature the supply bottom pressure of the standing gas stopped and bottom low pressure a standing sweep gas become into the filter press introduced and over the drainage and the collecting pipe discharged and the conversion of compressed gas (heating phase) on sweep gas (evaporation phase) and reverse becomes repeated, until the desired drying degrees of the cake achieved is; on which the dried filter cakes by opening the filter press in usual manner remote becomes.

As adverse considered becomes with this prior art process and the associated apparatus the carrying out the process that significant time a required is, in order to bring the filter cakes on a desired high drying degree. In addition relative high technical effort is a required by the alternate application of compressed gas and sweep gas, which makes the apparatus altogether expensive.

For the instant invention the object places itself to create an heating element that initially mentioned type a shortened drying time with an high drying degree of the filter cake possible, whereby the heating element should be more useful in place of used conventional heating elements in present filter presses, without become required for it larger changes or other cost-generating changes at the filter press.

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A first solution of the object posed succeeds to that with an heating element initially mentioned type, which is characterized by the fact that it is covered a body, which genoppt or rilliert to the formation of branching out, parallel heating medium channels in or reciprocally with exception of a circumferential edge region structured, preferably, and that each structured range of the body is sealing by one metallic plate each covered.

The heating element offers a very good thermal efficiency, because the metallic plate transfers the warm one from the heating medium very effective to the filter cake located on the other side of the plate. By this effective heat transfer a so called steam pressure drainage of the filter cake becomes possible, the particularly effective and a very rapid drying process of the filter cake on a very high drying degree of effected. For developing an uniform steam pressure front an effective and heat transfer uniform over the whole area of the heating element is required, which is according to invention ensured with the heating element. Thus one is sufficient in the ratio to conventional filter presses much short time for the remainder drying process of the filter cake, so that the throughput quantity per unit time can become substantial enlarged with a predetermined size of the filter press. Alternative ones can become with constant treatment time substantial higher drying degrees of the filter cake achieved. The use of a sweep gas is required now no longer. Further this first heating element according to invention offers the advantage that it is producible very inexpensive. The body can do almost unchanged of a standard filter element, z. B. a chamber filter element, to be taken over; additional simple on Ober- und underside the metallic plates mounted and sealing with the body connected becomes. In place of the one which can be dried

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Sludge becomes then into the heating element fluids the heating medium, z. B. hot water or hot oil or hot vapors or another appropriate means, introduced.

For the metallic plate is sufficient a relative small thickness, which can lie in the practice within the range of few mm. Thus this heating element is comparatively flexible, so that it can adapt to the differential pressures arising inside a filter press with their operation problem-free and without loss.

Prefered embodiments and materials for this first heating element according to invention are in the claims 2 to 4 indicated.

A second solution of the object succeeds according to invention with an heating element to that initially mentioned type, which is characterized thereby that it covers two parallel, lying on top of one another metallic plates, from which one or both bars, which exhibit rich in each case up to the other plate, raised at their the other plate of facing side to the formation of branching out, parallel heating medium channels, and that the two plates are set in by a circumferential frame sealing.

Also with this heating element a very good thermal efficiency becomes achieved, so that the steam pressure drainage reliable occurs also here, if the heating element with sufficient hot heating medium becomes charged.

The here used plates are preferably castings or cutting processed parts, which result in a sturdier form, as the explained above first embodiment of the heating element, whereby on the other hand however somewhat higher manufacturing costs in purchase taken to become to have. An other advantage consists still of the fact that the heat conduction from the heating medium is into the plates here particularly effective, because no body is present that

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the heat transfer punctually to decrease would know.

A third solution of the object posed succeeds to that with an heating element initially mentioned type, which is gekennzeichnet by the fact that it covers two parallel metallic plates, which are to the formation of branching out, parallel heating medium channels over at least one zigzag or wavy metallic intermediate layer connected with one another, and that the two plates are set in by a circumferential frame sealing.

With this embodiment of the heating element the two parallel plates are connected with one another over the intermediate layer, so that an extreme rigid construction results, which is not inclined also with high pressure differences on the two sides of the heating element to a substantial deformation. The heat transfer from the heating medium is particularly effective also by the intermediate layer and the plates on the filter cakes here, so that a very high thermal efficiency is ensured. That project here however relative high manufacturing costs counter, since connecting the metallic plates with the intermediate layer requires relative high effort.

For the intermediate layer exhibiting heating element is preferred provided that the intermediate layer exhibits at least bereichsweise, adjacent heating medium channels interconnecting breaking through longitudinal transverse to the longitudinal direction of the heating medium channels. In this way an uniform and effective flow of the entire heating element becomes ensured, so that over the whole surface of the plates an uniform high temperature adjusts itself, which is important for causing the steam pressure drainage within the filter cake.

Other embodiments and preferred materials for the second and third heating element according to invention are

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in the claims 8 to 10 indicated.

Further is preferred provided that the plates and the intermediate layer (n) are soldered with one another or welded or bonded if necessary. Thereby also a very good heat conduction becomes achieved beside an high mechanical stability.

An other embodiment, which is more applicable with all three heating elements according to invention, plans that at least ever a heating medium inlet and a heating medium discharge opening at two each other diametric opposite locations of the body or frame are provided that the heating medium inlet a edge-parallel distribution range follows that the distribution range the heating medium channels rectangular go off and parallel run to each other and that the heating medium channels a edge-parallel collection area flowing into the heating medium discharge opening follows. Those described arrangement of heating medium discharge opening and inlet as well as the channels planned between them provides here for an uniform flow of the entire heating element by the heating medium, because all paths which can be put back by the heating medium between inlet and outlet are essentially same prolonged. It is so ensured that no preferred flow paths on the side and weak or not flowed through dead ranges on the other side result.

A related alternative embodiment plans that at least ever a heating medium inlet and a heating medium discharge opening at two each other adjacent locations of the body or frame are provided that the heating medium inlet a radial distribution range follows that the distribution range the heating medium channels rectangular go off and parallel annular runs to each other and that the heating medium channels a radial collection area flowing into the heating medium discharge opening follows. Also

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with the here indicated flow guidance the desired uniform heating of the heating element becomes ensured.

A development of the heating element specified last plans additional that the annular longitudinal, different lengths are exhibiting heating medium channels in such a manner with different cross sections formed that all heating medium channels essentially exhibit the same heat transfer. Thereby undesirable temperature differences become within the plates avoided despite the different prolonged flow paths in the single heating medium channels.

⚠ :cp In order to be able to integrate heating elements according to invention problem-free as re-tooling heating elements in present filter presses, convenient is in each heating element, preferably in its center or in one of its corners, a breaking through sealed against the heating medium channels to the formation of a continuous mud A RUn for the adjacent, membrane filter elements in line provided. The layer of breaking through for the continuous mud intake depends on the construction of the found filter press, whereby the concrete layer of breaking through does not have effects on the function of the heating element.

For most cases of application of the heating element arising in the practice it is convenient that the outer surface of the plates is smooth. This offers the advantage that the filter cake drops after its drying process without problems of the plates or light of this remote can become.

Case those sludge of aggressive components which can be dried contained, which know the metallic plates attack, is provided that on the outer surface that

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Plates a thermal and chemical stable film or coating applied or is applyable. This film or coating very thin can be and are if necessary light renewable. On the other hand it disturbs the heat transfer due to its small thickness only into very small not measures adverse for the operation.

Alternative one exists the possibility that the outer surface of the plates structured genoppt or riilliert, preferably, is and that over the outer surface of the plates a filter cloth is stretchable. With this embodiment of the heating element the possibility exists to wash the filter cakes as a flushing liquid becomes passed by the filter cake. The liquid with the solved components from the filter cake can pass through then the filter cloth and become the structured portion of the surface of the plates a liquid drain guided. The subsequent drying process of the filter cake can take place then like before described, whereby only the heat transfer is less effective due to the reduced heat transfer-flat, which by a corresponding longer heating time or a higher Heizmediumtemperatuur balanced can become.

Embodiments of the invention become in the following explained on the basis a drawing. The figs of the drawing show: Fig 1 a filter press in a schematic side opinion, fig 2a to 2d a first heating element in plan view, in Longitudinal section, in end view and in the crosswise cut,

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Fig 3a to 3d a second heating element in same position as again in the figs 2a to 2d, and fig 4a to 4d a third heating element, in the same, representation managing specified.

The represented filter press 10 schematic in fig 1 possesses a press framework 11, which covers here essentially two vertical aligned end portions as well as this two interconnecting horizontal part. Between the end portions alternate several heating elements 1 and membrane filter elements 11 disposed, which have in each case the form of relative flat square bodies, are of which a front surface turned to the side in each case here are more visible. The filter press 10 is fillable over here a not represented filling line with one sludge which can be dried. Over drainage lines the deposited water is removable. Draining and drying become supported by a pressure medium, which is supplyable over fluid media lines 14 the membrane filter elements 11.

The heating elements 1 neten between two membrane filter elements each l'angeord are feedable over heating medium lines 13 ' with an heating medium, in order to bring the heating elements 1 on a desired temperature. By means of these heating elements the dewatered sludge at its contact surface with the heating elements becomes 1 so strong heated that a steam pressure front forms within the sludge, a very effective steam pressure drainage the effected.

The membrane filter elements 11 and heating elements 1 become 12 together pressed by an hydraulic operable cylinder, as this in the fig 1 shown is.

The discharge of the dried filter cake the cylinder becomes 12 so operated that with its piston an en

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bundener stamp drives to the right, so that then the membrane filter elements 11 and heating elements 1 on distance from each other brought can to become to be able and the dried filter cakes fall out downward.

Thus the before mentioned steam pressure front within the dewatered or predried filter cake developed, is an effective heat transfer from the heating elements 1 on the sludge or filter cake required. For this in the following the described embodiments of several heating elements are 1 suitable.

With the first embodiment of the heating element 1 represented in the figs 2a to 2d this possesses a body 2, which is provided apart from a circumferential edge region 21 with a structuring 20, here a Riillierung longitudinal in Längs- und transverse direction. Such a structure 20 is for example known of standard filter elements, whose drainage-flat can be identical performed. Thus a body 2 can be taken over by a standard filter element for the heating element 1. As material for the body 2 particularly plastics are suitable, for example polypropylenes.

Between the structuring 20 heating medium channels 3 formed, those essentially ran downward in the present example from above, in addition, in transverse direction in addition connected with one another are. Left above at the heating element 1 a heating medium inlet 31, which inside the heating element 1 a distribution range 32 follows, is in which the preferred direction of the heating medium channels horizontal runs. Down the vertical longitudinal heating medium channels a collection area 33 follows 3, is again horizontal in which the preferred direction. Right down at the heating element 1 a heating medium discharge opening is 34 provided, to that, just like at the heating

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medium inlet 31, preferably flexible heating medium lines are connectable.

As the figs 2a and 2d show, the body 2 with the heating medium channels 3 provided is reciprocal. On both sides of the body 2 is a metallic plate 4, z. B. from aluminium, stainless steel or titanium, sealing mounted. To the achievement of a smooth outer surface the plates are 4 flat-flush with the circumferential edge region 21 of the body 2 in this admitted.

In the center of the heating element 1 is a breaking through 5, which serves for the mud filling. The layer of breaking through 5 can be also different than in the drawing shown; it depends on the found construction of the filter press 10.

Finally still altogether four breaking through are 50 provided in the range of the four corners of the heating element 1, which permit the expiration of filtrate or Brüdenabzug.

Since with this first heating element 1 a body 2 of a standard filter element is more useful and since the plates can be 4 here simple sheet metal cuts, this heating element 1 particularly inexpensive is producible.

A second embodiment of an heating element 1 is in the figs 3a to 3d in same representation method as in the figs 2a to 2d shown. Characteristic one is for this embodiment that two plates become 4 used, which are 40 formed at their surfaces with raised bars, which can be pointed one on the other those up to in each case different the plate 4 rich. By these bars 40 heating medium channels 3 formed will run, in the present example in an approximate circular shape. For this are more immediate next to each other at the upper

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Face of the heating element 1 the heating medium inlet 31 and the heating medium discharge opening 34 provided and by one of the bars 40 from each other separated. The heating medium inlet a distribution range 32 longitudinal in radial direction follows 31 in the heating element 1, from which altogether three heating medium channels 3 proceed here, which are flowed through against the clockwise direction by the heating medium, as by the flow arrows indicated is. At the end of the heating medium channels 3 a collection area likewise longitudinal in radial direction is 33 provided, which flows into the heating medium discharge opening 34.

Further the fig 3b shows that the three heating medium channels are 3 with different cross section performed. The cross sections are so dimensioned that for all heating medium channels 3 the same heat output achieved becomes, so that the heat output is same over the whole surface of the plates 4 in each surface area.

The plates 4 are here set in by a circumferential frame 2', whereby also here the plates 4 to the formation

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leave are. The plates 4 also here preferably consist of aluminium, stainless steel or titanium and preferably are because of the bars 40 planned to it as castings or cutting processed parts prepared; the frame 2' preferably consists of plastic, in order to avoid an heat dissipation outward. Particularly suitable is for example polypropylene, also with this heating element 1 is in the center a breaking through 5 to the formation of a continuous mud A RUn for the membrane filter elements 11 in accordance with fig 1. At the four corners of the heating element 1 are also here again the breaking through 50 for Filtrat-und vapour removal provided.

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The figs 4a to 4d finally show a third embodiment of an heating element 1. Substantial one is with this heating element 1 that its two metallic plates 4 by a likewise metallic intermediate layer

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is obvious. In each case along the line of contact at the upper and lower apexes of the shaft is the intermediate layer 40' 4, preferably soldered or welded or bonded connected with the plates. Thereby a construction loadable particularly stable in itself and results.

Circumferential one is between the plates 4 a frame 21 some sets, which seals the heating element 1 all around. The arrangement of heating medium inlet 31 and discharge opening 34 corresponds here to the embodiment in accordance with the figs 2a to 2d; the same applies to the distribution range 32 and the collection area 33 as well as the course of the heating medium channels 3 within the heating element 1. Concomitantly between the single heating medium channels 3 in transverse direction currents

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light is.

Just like with the embodiments described before also here central breaking through is 5 for the mud intake provided as well as at the four corners in each case a breaking through 50 for Filtrat-und vapour removal mounted in the center of the heating element 1.